

Nejad, Maryam Naghsh; Ross, Amanda

**Conference Paper**

## Does Suburbanization Cause Obesity?

54th Congress of the European Regional Science Association: "Regional development & globalisation: Best practices", 26-29 August 2014, St. Petersburg, Russia

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Nejad, Maryam Naghsh; Ross, Amanda (2014) : Does Suburbanization Cause Obesity?, 54th Congress of the European Regional Science Association: "Regional development & globalisation: Best practices", 26-29 August 2014, St. Petersburg, Russia, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

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# Does Suburbanization Cause Obesity?

Maryam Naghsh Nejad  
*Institute for the Study of Labor (IZA)*  
*Bonn, Germany*

and

Amanda Ross  
Department of Economics  
West Virginia University  
Morgantown, WV 26506

## **Abstract**

In this paper, we examine the effect of suburbanization on obesity rates. Our study is an improvement over the existing literature because we will use county level data for our analysis, enabling us to look at the effect of moving from the central city to the suburbs. Previous research has only had health data at the MSA level, and therefore could not look at the effect of highways on obesity rates within an MSA, particularly the suburbs versus the central city. To estimate the relationship between obesity and highways, we will use county-level data on obesity rates from the Behavioral Risk Factor Surveillance System (BRFSS). We merge the obesity information with data on the proposed highway program of 1950 used previously by Baum-Snow (2007). Our results suggest that additional miles of a highway system increase obesity rates in urban areas.

## **I. Introduction**

The population in central cities in the United States has declined dramatically since the 1950s. However, there has been a growth in metropolitan areas as a whole, suggesting that individuals are still living in metropolitan areas but are moving out of the central city and into the suburbs. Baum-Snow (2007) examined this phenomenon and found that approximately one third of the decrease in aggregate central city population relative to the metropolitan area population overall can be explained by the expansion of the highway system. This finding is consistent with the findings from the standard Alonso (1964) model, which predicts that as commuting times decrease, individuals will migrate into the suburbs.

At the same time as this decrease in individuals living in the central city, the obesity rate in the U.S. increased dramatically. Between 1960 and 2006, the obesity rate increased from 13% to 34% (NCHS, 2008). Obesity is a concern for policy makers, as obesity has been linked to numerous health conditions, including diabetes, heart disease, and stroke. Given the timing of this increase and the migration from the central city, is there a relationship between suburbanization and obesity? As individuals move from the central city to the suburbs, people tend to rely more on cars for transportation. Therefore, individuals who reside in the central city will tend to get more exercise than their suburban counterparts. Also, the presence of big box stores in the suburbs reduces the price of food. Previous research has found that lower food prices cause increases in consumption (French, 2005). However, while big grocery stores may lower the price of food, it lowers the price of all types of food, including healthy foods (Jetter and Cassidy, 2006). In this paper, we examine this relationship between suburbanization and obesity, and look at the impact of highway construction on the rates of obesity within a metropolitan area.

Previous research has looked at the relationship between sprawl and obesity. Early papers were limited in their ability to provide causal estimates, as there is an endogenous selection problem where residents choose which neighborhoods to reside within. Later research attempted to address these selection issues by using fixed effects methods to control for unobserved individual attributes (Eid et al., 2008; Ewing et al., 2006; Plantinga & Bernell, 2007). One issue with these studies is that they used data from the National Longitudinal Survey of Youth. While the fixed effects do control for unobserved individual attributes, it is likely that the individual preferences of the survey participants vary over time. Therefore, the fixed effects will not control for all unobserved attributes, as these time-varying preferences are likely to be present in the estimates. Later work by Zhao & Kaestner (2010) utilized an instrumental variable strategy to address the concern regarding selection bias. We build upon this literature on urban sprawl and obesity by looking not at obesity rates across cities, but how changes in the highway system affect obesity within a city.

The interstate highway act of 1944 is the starts of a series of planned highways across the United States that were primarily funded by the federal government. However, state and local governments using their own funding adjusted metropolitan area highway infrastructure partly in response to local commuting demand. As a result looking at the total current highways in Metropolitan Statistical Areas would not give an exogenous variation to the development of cities, as there was an endogenous selection process by the local governments.

Following the work of Baum-Snow (2007) we use rays of highways from the 1947 Eisenhower Highway Plan as to estimate the effect of highways on the number BMI within an MSA. We obtained data on individual characteristics including BMI, age, gender, education, and

income we use the annual survey of Behavioral Risk Factor Surveillance System (BRFSS). We currently use data from 1997 to 2003, but in future work we plan to extend the sample to 2012.

We find evidence that additional highways cause increases in obesity. This finding supports the arguments that suburbanization is causing obesity rates in the United States to rise. Some reasons that this may be occurring is that individuals are exercising less as they are driving more instead of walking. In addition, as highways develop and big box stores become more prevalent, the cost of food decreases and therefore individuals may choose to consume more calories than they did previously. Our future research will continue to examine these mechanisms of how suburbanization may be causing obesity.

## **II. Previous Research**

Rising obesity rates has become a major public health concern and economists have entered the debate on what may be the cause. Changes in obesity rates are interesting to economists as the choices associated with it are based on weighting the costs and benefits of consuming different amounts of calories (Courtemanche & Carden, 2011). Reasons for the increase in obesity can be traced to various changes in the opportunity cost for individuals. For example, Cutler et al. (2003) argue that rising obesity rates can be attributed to technology making the food preparation process easier. If it takes less time to prepare food, individuals are more likely to over eat. In addition to cooking within the home, technology to prepare food outside the home has also improved, which can cause the price of food to decrease in the market and individuals to consume more as portion sizes have increased (Philipson & Posner, 2003; Lakdawalla & Philipson, 2002; Chou et al., 2004).

Courtemanche and Carden (2011) look at the impact of opening a new Wal-Mart supercenter in a local jurisdiction on obesity rates. Using an instrumental variables approach, where the instrument exploits the geographical pattern of expansion around the headquarters in Arkansas, the authors find that the proliferation of Wal-Mart explains 10.5% of the rise in obesity since the 1950's. Tying these arguments to urbanization, as more individuals move into the suburbs near these big box stores, which have lower prices, individuals will end up consuming more calories and obesity rates will increase.

Alternatively, some researchers argue that obesity rates have increased as we have become more suburbanized because individuals walk less. Christian (2011) found that increasing commute times has led to decreases in time spent doing other health related activities, such as spending less time preparing food and less time exercising. In addition, as individuals move out of the central city, they are more likely to drive to work than to walk, which further decreases the activity level of individuals.

Eid et al. (2008) looked at the literature between urban sprawl and obesity and argued that there is a selection process that these papers failed to deal with that is likely to bias the estimates. To address these problems, the authors used data that tracks individuals over time to control for unobservable individual attributes. They did not find the positive effect that existed in the literature, suggesting that obesity was not caused by suburbanization but was a matter of individuals who had a propensity to be overweight choosing to live in those areas. Plantinga and Bernell (2007) used a similar identification strategy of tracking individuals and found additional evidence that there was a selection issue present that is causing researchers to obtain biased estimates of sprawl on obesity. Later work by Zhao & Kaestner (2010) utilized an instrumental variable strategy to address the concern regarding selection bias.

We build upon this literature on urban sprawl and obesity by looking not just at obesity rates across cities, but how changes in the highway system affect obesity within a city. This is a significant contribution to the literature as changes in the highway system are likely to have the greatest effects within a given city than across cities. This enables us to control for additional unobserved variables about individuals in different cities that may be correlated with obesity rates.

### **III. Empirical Strategy and Data**

We obtained the data on planned and completed highways come from Baum-Snow (2007). This data set created by Baum-Snow contains the mileage of highways that are completed and open in each country in each year. In addition, this data set has information on what was planned in terms of highway construction from the 1947 Eisenhower Highway Plan.

Data on individual characteristics was obtained from the Behavioral Risk Factor Surveillance System (BRFSS), which is a survey conducted annually by the Center for Disease Control (CDC). This data set contains a wealth of information on individual's health behavior, including questions about the general health of individuals, level of physical activity, and smoking and other types of behavior. In this paper, we focus on the information on the Body Mass Index (BMI) of the individuals. BMI uses information on an individual's weight and height to determine if that person is underweight, average, overweight, or obese. While this measure is not a perfect indicator of health, as it does not account for muscle mass or bone density, it is generally the measure used to determine rates of obesity.

We estimate the effect of the number of planned highways on the BMI of the residents within counties of Metropolitan Statistical Areas. In doing so, we control for level of education. In this

data, level 1 refers to individuals who have never attended school, level 2 refers to those who have completed grade 1 through 8, and level 3 refers to those with grade 9 through 11. Level 4 are those with grade 12 or GED degree. Individuals with 1 to 3 years of college are in level 5. Level 6 refers to those with 4 years of college or more. In addition to these education measures, we include a variable that includes different levels of income. Level 1, includes those individuals with less than 10000 dollars annual income. Levels 2,3,4,5,6, and 7 refer to those with annual income of 10000 to 14999, 15000 to 19999, 20000 to 24999, 25000 to 34999, 35000 to 49999, and 50000 to 74999 respectively. The income variable is 8 for those with annual income of 75000 or more. We also include dummy variables for gender, (one stands for male, and 2 for female.), having a health insurance plan, (1, yes. 2 no), and married (one married and two not currently married).

We also control for smoking the behavior to account for underlying health factors of the individual. A value of 1 indicates the individual is a smoker who smokes at least once a day. A value of 2 for this variable indicates an individual who smokes some, but not all day. If a person is a former smoker, there is value of 3 for this variable and those that never smoked have a value of 4. Summary statistics of all these variables are presented in Table 1.

In addition to the control variables, we use state and year fixed effect to control for unobserved characteristic within each state and also across time. We also estimate models where we include MSA fixed effects instead of state fixed effects, as it is likely that there is variation across MSAs within a state.

#### **IV. Results**

The preliminary results are presented in Table 2. In all of the specifications, we find that an increase in the mileage of planned highways in a county within an MSA is associated with



increases in BMI. We include state and year fixed effects in the models in columns 1-4, while in column 5 we include MSA fixed effects instead of state fixed effects. In all the models, we control for education, income, gender, and age. In column 2, we add a control for if the individual is a smoker. In column 3, we add a dummy for married individuals, and in column 4, we add a dummy variable for individuals that have a health insurance plan. As you can see, adding these additional controls does not cause change the pattern of results found that additional highway miles cause an increase in obesity rates. In column 5, we include all the controls discussed above, as well as MSA fixed effects.

As can be seen in Table 2, our results are consistent across different specifications. A one mile increase in the number of planned highways within a county is associated with a 0.02 percentage point increase in the BMI of that county. This suggests that as there are more highways and more suburbanization, individuals are more likely to be overweight. This is consistent with the argument that highways are likely to cause individuals to walk less and become less active.

The coefficient on the education variable is negative and significant. A one level increase in education is associated with seven percentage point decrease in BMI. Similar relationship holds for level of income, higher incomes are associated with lower BMI. One explanation of this negative effect is that the more educated an individual is, the more the person is likely to know and understand healthy eating and therefore is less likely to be overweight. Furthermore, there is evidence that healthy food is more expensive than unhealthy food. Given this, it is not surprising that higher income is associated with lower BMI. Alternatively, we found that older individuals and people who are married are both associated with higher BMI.

## **V. Conclusions and Future Research**

Based on the preliminary results of this research, we found that an increase in highway mileage in the 1944 Eisenhower Highway Plan is associated with higher BMI in a given county. This is consistent with the previous literature association obesity with urban sprawl and suggests that highways and suburbanization are playing a significant role in the increased obesity rates in the United States. The two main mechanisms discussed that are likely to cause this positive effect is the decrease in the price of food as a result of suburbanization, as well as a decrease in activity level as individuals drive more and walk less.

This paper is still in the preliminary stages. For our next steps, we first plan to extend the data up to 2012. Once this is done, we will be able to examine more closely the long-term effects of the highway expansion on the obesity with the MSAs. We also plan to exploit more of an instrumental variables approach regarding the planned miles and actual miles to control for the endogenous selection of where local governments chose to invest highway dollars. Furthermore, we want to examine more the variation within MSAs, to account for how changes in the highway plans affect the obesity rates within a jurisdiction. This type of an analysis will allow us to control more thoroughly for unobserved attributes of a local area that may be correlated with obesity rates.

## References

- Chou, S., M. Grossman, and H. Saffer (2004). "An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System," *Journal of Health Economics*, 23, 565-587.
- Christian, T. (2011). "Trade-Offs between Commuting Time and Health Related Activities," *Journal of Urban Health*, 89(5), 746-757.
- Courtemanche, C. and A. Carden (2011). "Supersizing Supercenters? The Impact of Wal-Mart Supercenters on Body Mass Index and Obesity," *Journal of Urban Economics*, 69(2), 165-181.
- Cutler, D., E. Glaeser, and J. Shapiro (2003). "Why have Americans become More Obese?" *Journal of Economic Perspectives*, 17, 93-118.
- Eid, J., H. Overman, D. Puga, and M. Turner (2008). "Fat City: The Relationship between Urban Sprawl and Obesity," *Journal of Urban Economics*, 63, 385-404.
- Lakdawalla, D. and T. Philipson (2002). "The Growth of Obesity and Technological Change: A Theoretical and Empirical Investigation," National Bureau of Economic Research Working Paper 8965.
- National Center of Health Statistics (2008). "Prevalence of Overweight, Obesity, and Extreme Obesity among Adults: United States, Trends 1976-1980 through 2005-2006."
- Philipson, T. and R. Posner (2003). "The Long-Run Growth of Obesity as a Function of Technological Change," *Perspectives in Biology and Medicine*, 46, S87-S108.
- Plantinga, A. and S. Bernell (2007a). "The Association between Urban Sprawl and Obesity: Is it a Two-Way Street?" *Journal of Regional Science*, 47(5), 857-879.
- Plantinga, A. and S. Bernell (2007b). "Can Urban Planning Reduce Obesity? The Role of Self-Selection in Explaining the Link between Weight and Urban Sprawl," *Review of Agricultural Economics*, 29(3), 557-563.
- Zhao, Z. and R. Kaestner (2010). "Effects of Urban Sprawl on Obesity," *Journal of Health Economics*, 29, 779-787.

Table 1: Summary Statistics

	mean	min	max	sd	count
BMI	280.59	0.15	1000.00	121.09	535825
Length of planned highway	39.28	0.00	379.00	37.65	535825
Education level	4.89	1.00	6.00	1.04	535824
Income level	5.60	1.00	8.00	2.03	535825
Age	45.87	9.00	99.00	16.60	535825
Gender	1.58	1.00	2.00	0.49	535825
Smoker	3.12	1.00	4.00	1.12	535825
Married	0.52	0.00	1.00	0.50	535825
Health plan	1.11	1.00	2.00	0.31	535825
<i>N</i>	535825				

Table 2: Impact of Highways on Obesity

	BMI	BMI	BMI	BMI	BMI
Length of planned highway	0.0195*** (0.0059)	0.0185*** (0.0059)	0.0207*** (0.0059)	0.0205*** (0.0059)	0.0014 (0.0291)
Education level	-6.7660*** (0.1765)	-7.5748*** (0.1783)	-7.1729*** (0.1794)	-7.0896*** (0.1798)	-6.7814*** (0.1813)
Income level	-1.7301*** (0.0920)	-1.8968*** (0.0921)	-2.7225*** (0.1011)	-2.5946*** (0.1031)	-2.5502*** (0.1040)
age	0.0388*** (0.0100)	0.0229** (0.0100)	0.0060 (0.0100)	0.0192* (0.0102)	0.0219** (0.0103)
sex	7.4704*** (0.3343)	6.7318*** (0.3348)	6.9305*** (0.3348)	7.0529*** (0.3354)	7.0059*** (0.3354)
Smoker		4.6385*** (0.1498)	4.4118*** (0.1502)	4.4734*** (0.1505)	4.4728*** (0.1508)
married			7.2093*** (0.3656)	7.2474*** (0.3656)	7.1789*** (0.3678)
Health plan				3.5642*** (0.5546)	3.5994*** (0.5551)
State fixed effect	Yes	Yes	Yes	Yes	No
MSA fixed effect	No	No	No	No	Yes
<i>N</i>	535824	535824	535824	535824	535824
adj. <i>R</i> <sup>2</sup>	0.023	0.025	0.026	0.026	0.027

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$